

# *Yellow Wind*



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# *Overview*



- Yellow Wind ... What is it?
- What causes Yellow Wind?
- What are the effects in Korean and Japan?
- 4 phases of a Yellow Wind episode
- Synoptic illustrations
- Forecasting Visibilities
- Helpful Forecast decision tables

# *Yellow Wind ... What is it?*



- The Yellow Wind source material is from a substance called “loess”, found in the Loess Plateau, which is located in the southern region of China, known as Inner Mongolia. The Loess Plateau is bounded on the north by the Great Wall of China and to the south by the northern slopes of the Tsinling Shan. The average altitude of this region range between 4,000 to 5,000 feet with a few higher bedrock levels of 9,000 feet or more.
- The greatest quantities of loess in the world are found in China. The thickness ranges from 400 to 700 ft. Loess is a mixture of many particles of rocks and minerals. Sand and organic particles from the Gobi Desert, which is downwind to the Loess Plateau, mixes with the loess, thus creating a yellow substance which is then lifted by the wind creating the yellow wind.

# *What causes Yellow Wind?*



- Yellow wind occurs yearly between February and May with an average of 10 episodes a year. The prime months for this event to occur is April and May. Strong winds up to 20,000 ft and higher will advect dust and fine sand from the Gobi Desert and Loess Plateau from Inner Mongolia and Inner China, into Korea, Okinawa and Japan. The dust usually has a lesser effect downstream in Okinawa and Japan, but can still effect flying operations.
- Trailing cold fronts from Mongolian lows often cause the advecting dust. When the low moves past Lake Baikal in Russia, a strong cold frontal system will push the trailing dust 24 to 30 hours later into Korea, 48 to 56 hours into Japanese stations, and 56 to 60 hours later into the Okinawa region.

# *What are the effects in Korea and Japan?*

- **Korean effects:** The Yellow Wind occurs 2 to 3 times each spring, within 1 day after an intense cold frontal passage. The dust lowers visibility to 2-4 miles, and occasionally to a mile or less. Normally, visibility is 3 to 5 miles from 500ft to 20,000 ft (AGL), but can go as low as 2 miles.
- **Okinawa effects:** Yellow wind occurs 2-3 days after intense cold frontal passage, reducing visibility as low as 2-3 miles. Visibility is lowest during the day and improves at night, when the dust settles. This dust often affects visibility up to 20,000 ft and may persist for 1 to 3 days.
- **Japanese effect:** Visibility is reduced up to 20,000 ft. However, the Japanese Alps blocks effects on their lee side, location of most US bases. On the windward side, dust effects are similar to that over Korea.

# *The 4 phases of a Yellow Wind episode*



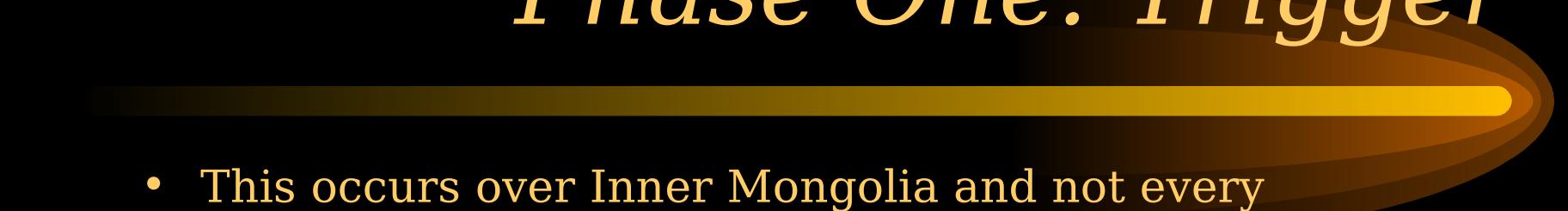
Phase 1: Trigger

Phase 2: Eastward Young  
Dust

Phase 3: Dusty Korea

Phase 4: Bye

# *Phase One: Trigger*



- This occurs over Inner Mongolia and not every disturbance will create a dust storm. The following conditions help trigger a dust storm.
- ***A SW-NW oriented cold front or trough***
- ***500 mb heightfalls of 100 meters or greater***
- ***Broad northwesterly low level jet behind the front/trough of at least 30 knots***
- ***Northwesterly surface winds of 20 to 30 knot***
- The trigger phase ends when the leading edge of the dust leaves the Gobi Desert and collects greater amounts from the Loess Plateau.

# *Phase two: Eastward Young Dust*

- **Dust aloft increases as it moves over the Loess Plateau.**
- A broad northwesterly low level jet continues over this area driving the dust through the valleys and mountains passes to the east.
- The dust advances at 60% of the speed of the low level jet.
- Visibilities from 1/4 to 1 mile are reported on the Loess Plateau.
- The densest dust will usually be to the right of the jet unless there are frequent episodes and if the jet remains broad.
- A precipitation shield usually develops with the system ahead of the dust.
- The dust will usually appear as a fuzzy area behind the system if not masked by higher cloud decks.

# *Phase three: Dusty Korea*



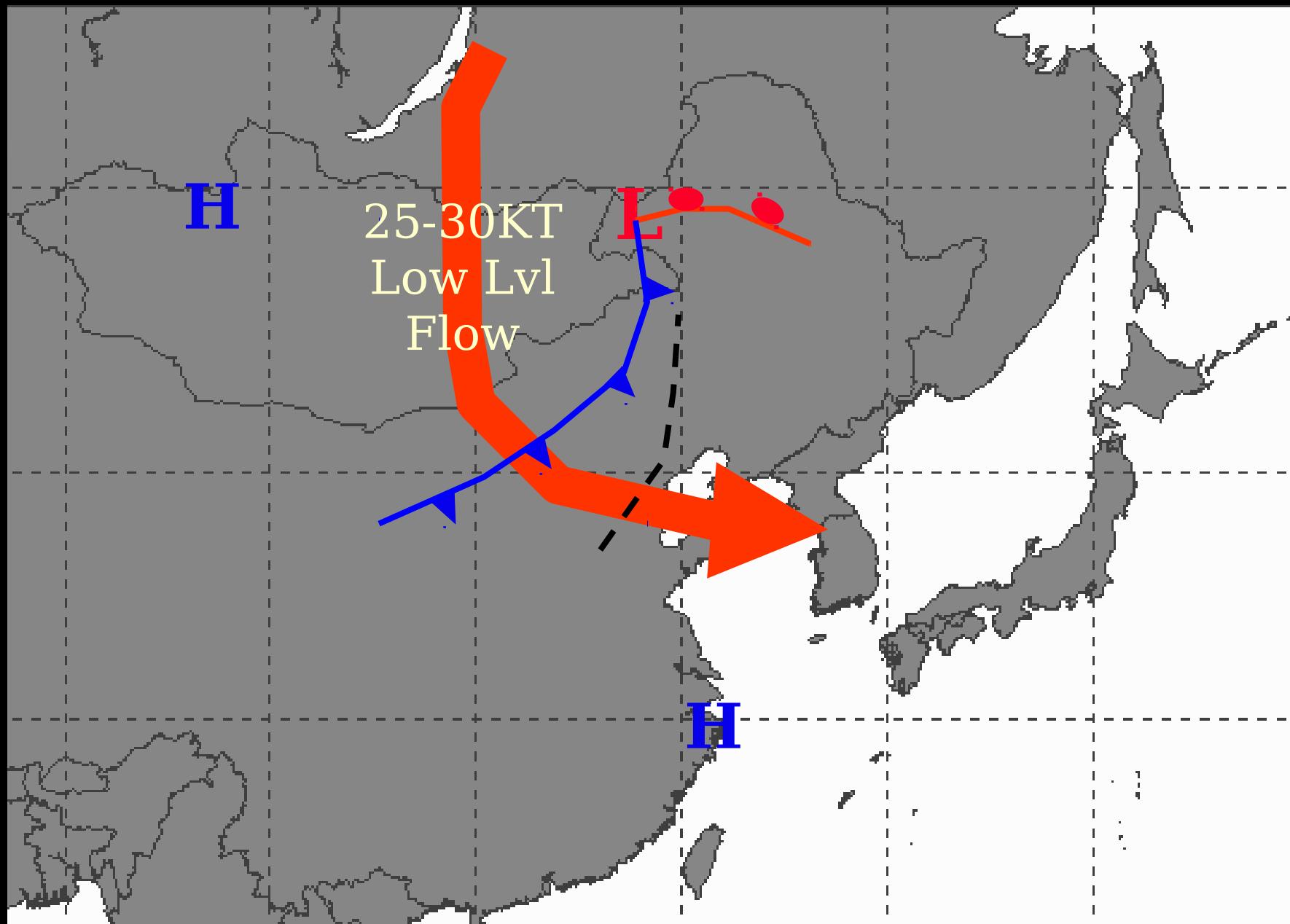
- **This phase brings the dust across the North China Plain and Yellow Sea to Korea.**
- An upper level low moves into southern Manchuria from the west, northwest or north.
- A secondary trough, either at the surface or upper level, and moves to or develops northwest of Korea. This feature must move through the ROK.
- The low level jet shifts itself to a more west-northwesterly orientation as it moves across the Gulf of Pohai, thereby providing a direct drive into the ROK.
- Visibilities improve in eastern China (1 to 4 miles) prior to the dust hitting Korea.

# *Phase four: Bye*

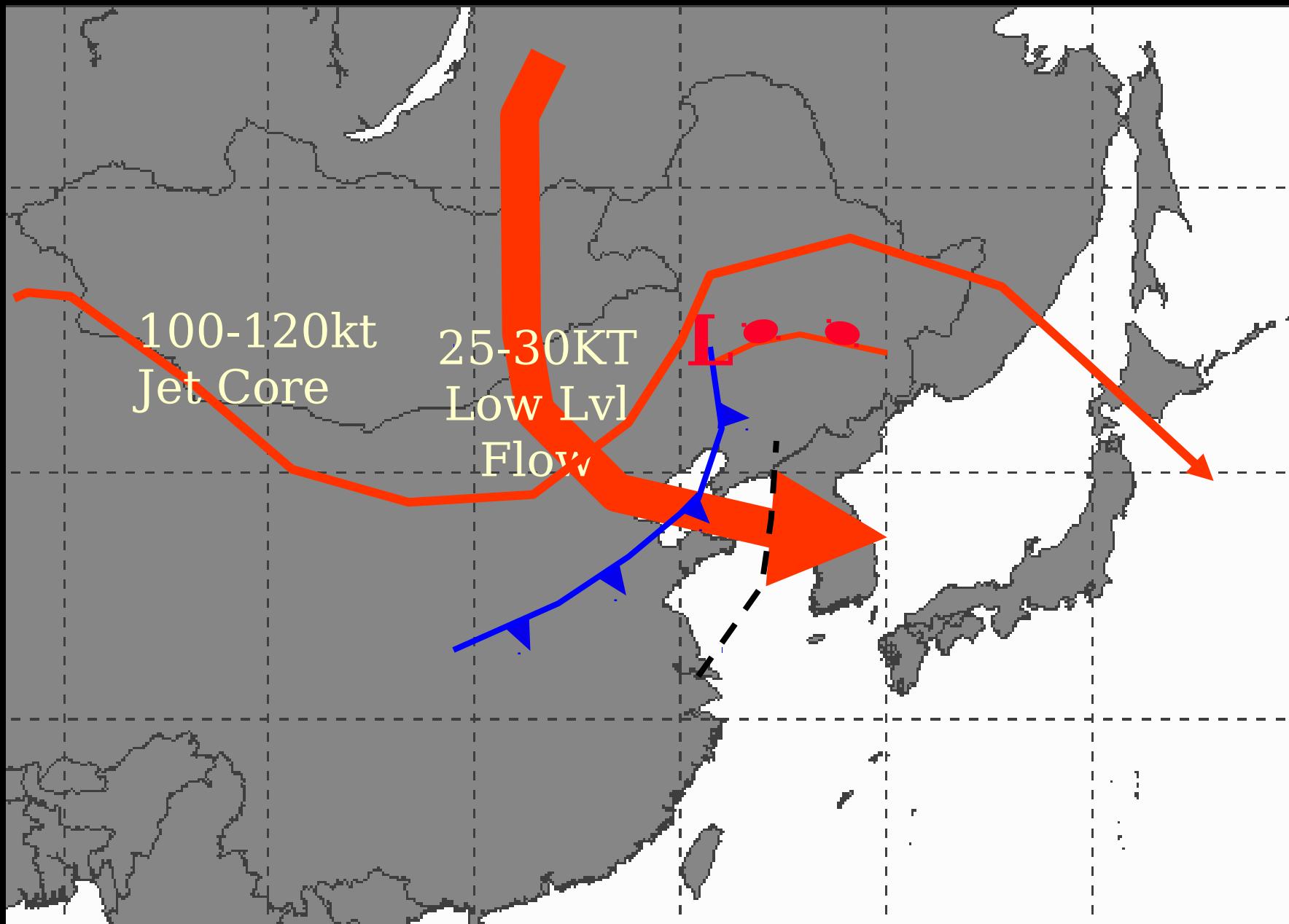


- ***The dust does not usually clear out as rapidly or as dramatically as it moved in.***
- The upper level low moves east.
- The secondary trough pushes through the ROK.
- The low level jet becomes northerly over the ROK and westerly if to the south of the ROK.

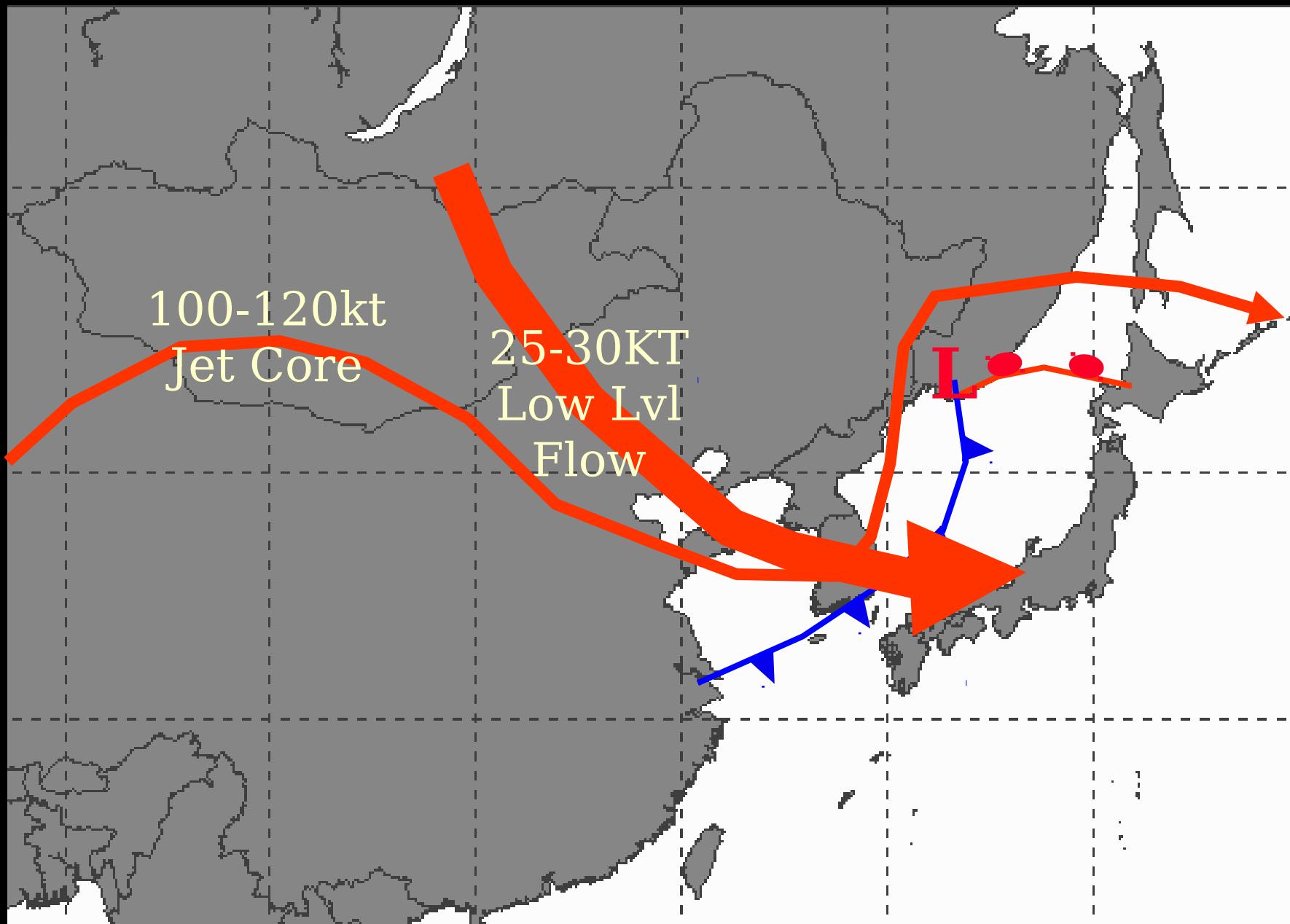
# Surface Features



# Surface and 300 mb Jet



# Surface and 300 mb Jet



# *Forecasting Visibilities*



- Advection: Forecast the same visibility category which was last reported upstream. This has a 70% degree of certainty/accuracy.
- Downward vertical velocities will bring more dust to the surface. Use visibilities east of 115 degrees east and between 31 to 40 degrees north
  - If upward, forecast one category better
  - If downward, forecast one category lower
- The above rule of thumb does not work well within 12 hours, but has been true 60% of the time between the 12 and 24 hour point.

# *Dust Decision table for Korea*

- **Q1 Is the dust prevalent in the ROK?**
  - Yes, go to table C
  - No, go to question 2
- **Q2 Is the dust in far eastern China (east of 115E)?**
  - Yes, go to table A
  - No, go to question 3
- **Q3 Is the dust east of 110E?**
  - Yes, Go to table B
  - No, go to question 4
- **Q4 Is a southwest to northeast oriented cold front or trough moving through the Loess Plateau?**
  - Yes, answer questions 5A, 5B and 5C
  - No, End no dust threat
- **Q5A Does it have a broad NW low level jet of at least 30 knots?**
- **Q5B Does it have at least 100 meter heightfalls at 500 mb?**
- **Q5C Does it have surface winds reaching at least 20 to 30 knots?**

- If 2 of the 3 questions are no, end, there is no dust threat. Otherwise, be prepared for an episode of “Yellow wind” within 48 hours. If the dust starts blowing around in the Loess Plateau, plot the worst visibility reported over a 12 hour period to give you an idea of what the intensity of the event will be.

# TABLE A

- Procedure: Answer the following questions yes or no. Then add up the points to determine the “Yellow Wind Index”. Find index category on the table. If the answer is yes for dust, use the visibility that is being reported in far eastern China.
- Q1 Is the upper level low moving toward or expected to move into southern Manchuria within 24 hours? Yes = 5 points No = 0
- Q2 Is there a secondary trough moving into the Yellow Sea within 24 hours? Yes = 3 pt No = 0
- Q3 Do any of the 6, 12, 18, or 24 hour 850 mb parcels move through or start in the in the area of dust and is progged into your area? Yes = .5 points per parcel. No = 0
- Q4 Do any of the 6, 12, 18, or 24 hour 700 mb parcels move through or start in the in the area of dust and is progged into your area? Yes = .5 points per parcel. No = 0
- Q5 Os the 850 or 700 mb jet broad or narrow? Broad, go to Q6A Narrow, go to Q6B

# *TABLE A (continued)*

- Q6A Are either of the jets aimed at Korea? Yes = 5 points No = -2 points
- Q6B Is Korea up to 300 miles to the right of the extension of the narrow jet? Yes = 5 pt No = -1 points

## INDEX TABLE

**12 pts or Greater = Yes, up to 36 hours**

**8 to 11 points = Maybe**

**7 points or less = No**

# *TABLE B*

- **Procedure: Answer the following questions yes or no and add the points to determine the “Yellow Wind Index” Then check the table to determine the likelihood of Yellow wind.**
- Q1 Is the upper level low forecasted to move into southern Manchuria during the 24 to 60 hour time frame? Yes = 4 points No = 0 points
- Q2 Is there a secondary trough forecast to move into the Gulf of Pohai in the next 24 to 48 hours? Yes = 4 points No = 0
- Q3 Do any of the 24, 30, 36, or 48 hour parcels start in or move through the area of dust? Yes, for any parcels, go to Q3A No, for all parcels go to Q4
- Q3A Is the parcel starting less than 7 degrees (400 miles) behind the dust? Yes = 5 points per parcel No = 0 points
- Q4 Do any of the 24, 30, 36, or 48 hour 700 mb parcels start in or move through the area of dust? Yes, go to Q4A No, for all parcels - total all points and go to the table.
- Q4A Is the parcel starting less than 10 degrees (600 miles) behind the dust? Yes = .5 points per parcel No = 0

# *Index Table B*



- 9 points or greater = Yes in the 36 to 60 hour time frame
- 5-8 points = Maybe
- 4 points or less = No

# *Table C*

- **Q1 Is there an upper level low in Southern Manchuria?**
  - Yes, go to Q2
  - No, do not go further on this table. Case studies had this prerequisite.
- **Q2 Will the upper level low move east of 130E in 24 hours?**
  - Yes, go to Q3
  - No, the dust will linger for at least 18 hours
- **Q3 Is another trough moving into the Korean peninsula?**
  - Yes, the dust will clear out with the trough
  - No, the dust will gradually clear